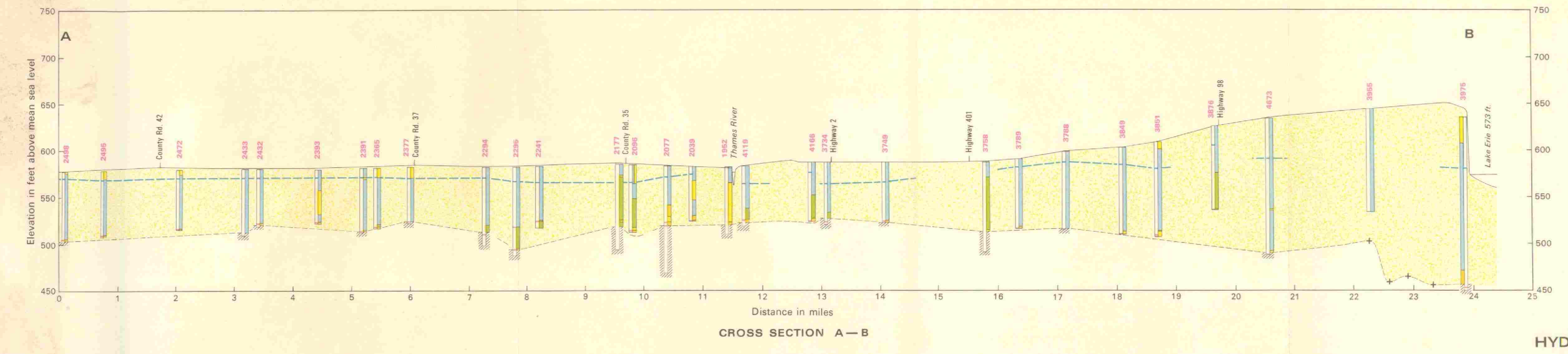
GROUND WATER PROBABILITY MAP

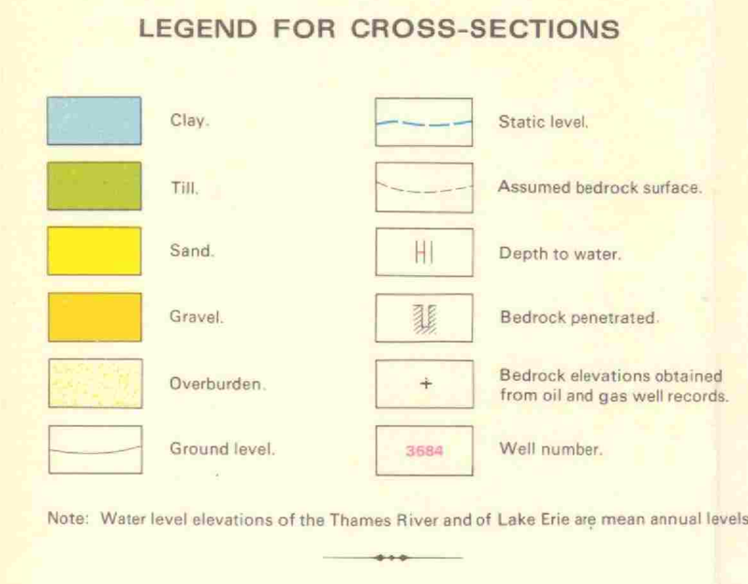
COUNTY OF KENT

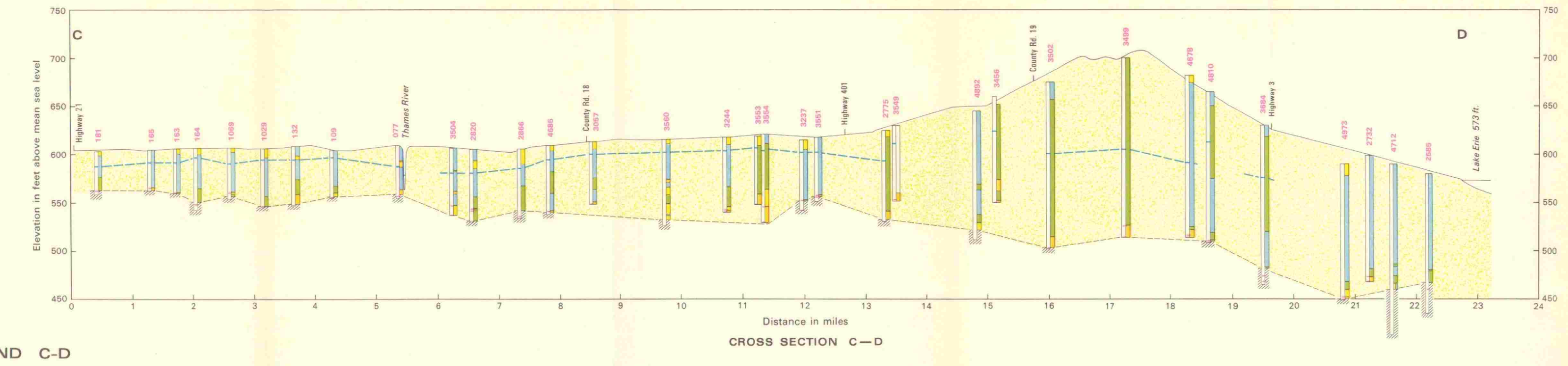
This map was compiled by the Hydrologic Data Branch of the Commission's Division of Water Resources.

ONTARIO WATER RESOURCES COMMISSION
135 St. Clair Avenue West Toronto 195, Ontario

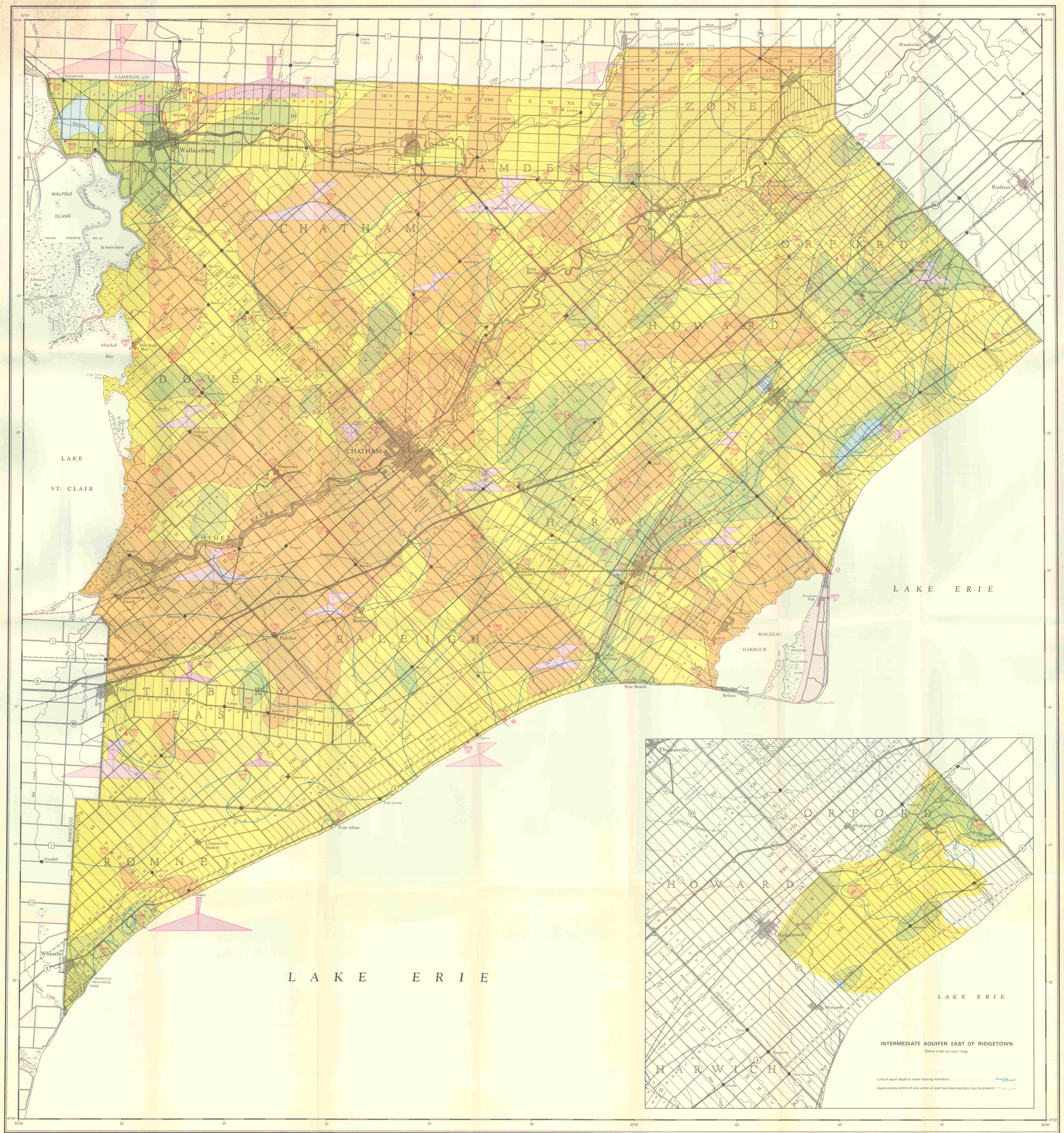
1970







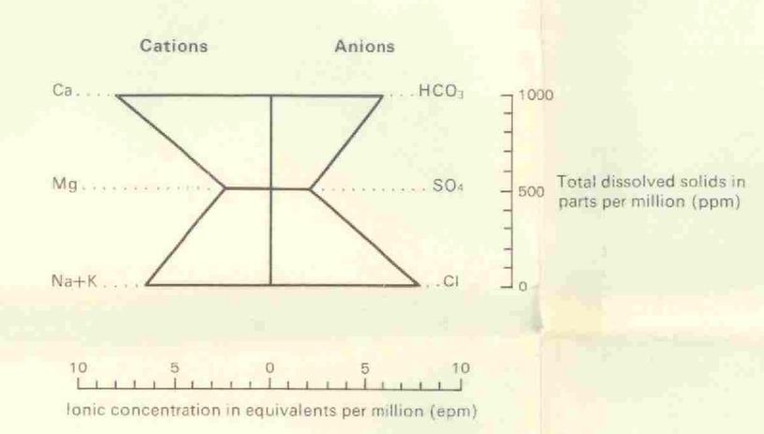
HYDROGEOLOGICAL CROSS-SECTIONS ALONG LINES A-B AND C-D



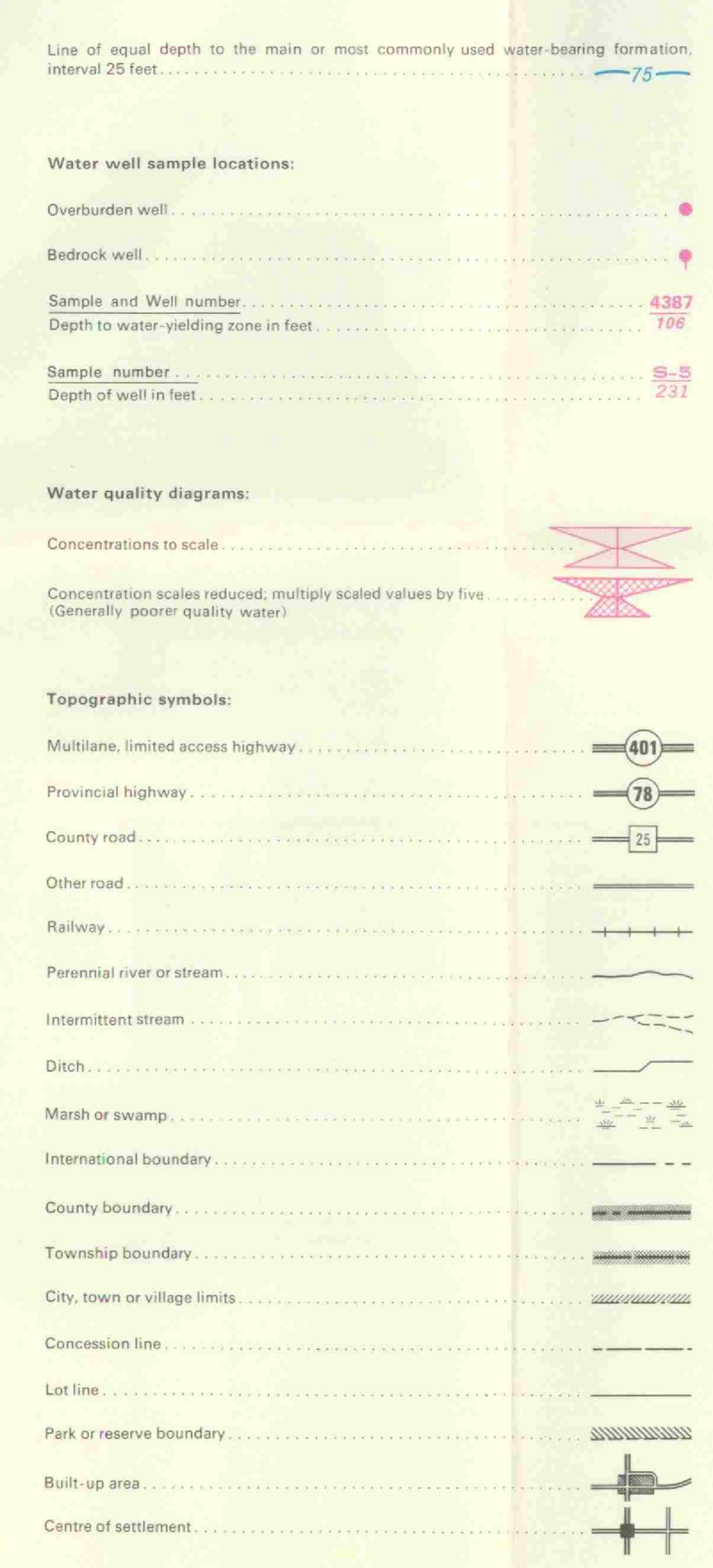
LEGEND

- Areas where wells are likely to produce less than two gallons per minute. Difficulties are encountered in obtaining sufficient quantities of water for any purpose.
- Areas where wells are likely to produce two to ten gallons per minute. Supplies are generally adequate for domestic and stock purposes.
- Areas where wells are likely to produce ten to fifty gallons per minute. Supplies are generally plentiful for domestic and stock purposes, adequate for most commercial and small industrial purposes, but poor to fair as a supplemental source for irrigation.
- Areas where wells are likely to produce more than fifty gallons per minute. Supplies are generally adequate for most irrigation and many municipal uses.
- Areas where surface or near-surface sands are at least fifteen feet deep. Yields may be adequate for domestic and stock purposes. Outline of area is defined from well records.
- Areas where surface or near-surface sands are at least fifteen feet deep. Yields may be adequate for domestic and stock purposes. Outline of area is assumed, well record information is lacking.

EXPLANATION OF WATER QUALITY DIAGRAM



SYMBOLS



SOURCES OF INFORMATION

Probability of ground water by A. A. Mellary and E. P. Kilburn, 1969.

Water samples taken by C. E. Snider, 1969.

Water samples analyzed by OWRC Laboratory and by C. E. Snider.

Well information from:

Water-well records on file with the Ontario Water Resources Commission.

Oil and gas well records published by the Ontario Department of Energy and Resources Management.

Selected references:

Caley, S.F., and Sanford, B.V., 1952, Preliminary Maps, Kent County, Ontario, showing Drift-Thickness and Bedrock Contours, Geological Survey of Canada, Paper 52-4.

Chapman, L.J., and Putnam, D.F., 1966, The Physiography of Southern Ontario, University of Toronto Press.

Sanford, B.V., 1958, Geological Map of Southwestern Ontario, Geological Survey of Canada, Map 1062A.

Cartography by R. Zimmermann, 1970.

Base map derived from 1:50,000 sheets of the National Topographic Series, and from Ontario Department of Highways maps.

DESCRIPTIVE NOTES

INTRODUCTION

Ground water is an important source of water supply in the County of Kent which is in southwestern Ontario. In spite of its importance, the ground-water supply in the county is generally limited.

The ground-water probability map is prepared from water-well records filed with the Ontario Water Resources Commission, field and laboratory quality analyses, and other limited information on the ground-water resources of the county. It is intended as a convenient guide to the probable availability and chemical quality of ground water in the county, and to the depths to the main or to the most commonly used water-bearing formations.

The Rondeau Provincial Park area was not evaluated due to the lack of available information.

USE OF MAP

A prospective well site can be evaluated by the following steps:

1) **Locate the proposed well site on the map.**
2) **Find the probable quantity by reference to the legend.**
3) **Locate the nearest sampling points and check their analysis listed in Tables 1 or 2 to obtain an idea of the probable quality.**
4) **Note the depth from ground level to the top of the main or most commonly used water-bearing formation.**

Probability Ranges

Yields are indicated in four ranges with comments on adequacy of each range:

less than 2 gpm — inadequate to marginal for any purpose
2-10 gpm — marginal to adequate for domestic or stock purposes.
10-50 gpm — adequate for most commercial, small industry and farming purposes.
greater than 50 gpm — adequate for most irrigation and many municipal uses.

An area was placed in a certain probability range if more than 50 per cent of the wells in that area had calculated yields within that range. The ranges of probable yields represent quantities of water that can be expected from individual wells. A well drilled within an area of a particular range may not necessarily produce at a rate within that range, but there is a better than 50 per cent chance that it will. The ranges were determined from reported, short-term pumping tests and may not necessarily represent long-term yields. The determination of yields must still depend on specific investigations with use of the map as a ready guide to the quality, probable yield and depth to water.

The depth from land surface to the top of the main or most commonly used water-bearing formation is shown using 25-foot contour intervals.

The hatched portion of the map in the Bothwell-Chatham area indicates surface sands at least 15 feet deep which may yield adequate supplies from sandpoints for domestic and stock purposes. The probable yield, depths, and quality shown for this area are for the deeper water-bearing formation.

In an area southeast and east of Ridgetown, the thickness of overburden exceeds 200 feet. Although the majority of the wells penetrate the entire overburden to the upper few feet of the shale bedrock, some wells were developed in sands and gravels up to more than 100 feet above the bedrock in areas where the bedrock is depressed. The inset map indicates the probable yield, depths and quality for this intermediate aquifer.

The two cross-sections, along lines A-B and C-D, show depths where water was found, static levels, the major overburden materials, and the bedrock at selected well locations.

Water Quality

Water quality analyses are listed in Tables 1 and 2 by well numbers or sample numbers. The sampling points are indicated on the map. Sixty-nine water samples were analyzed in the field for hardness, alkalinity, pH, chloride and iron. Twenty-five samples were analyzed at the OWRC laboratory for these and additional parameters: calcium, magnesium, sodium, potassium, bicarbonate, sulphate, fluoride, total dissolved solids and conductivity. Twenty-four additional analyses which were done at the OWRC laboratory for previous ground-water studies are also included. Table 1 contains water quality analyses performed in the laboratory and sodium adsorption ratios and Table 2, the results of the field analyses.

Diagrams, drawn to the scales in the legend, indicate the locations and seven water quality parameters for the twenty-five samples that were analyzed in greater detail.

The chemical analyses indicate that the quality of ground water in the county is quite variable. About thirty-five per cent of the samples had chlorides above the recommended limit of 250 ppm for drinking water. Iron is above the recommended limit of 0.3 ppm in 80 per cent of the samples. The sulphate concentration is negligible in most samples. Thirty-five samples were analyzed for fluoride content and 40 per cent were higher than the preferred value of 1.2 ppm, but none exceeded the acceptable limit of 2.4 ppm. The water is generally hard to very hard. The hardness in one quarter of the samples is greater than 180 ppm, which is considered very hard. Water from the shallow aquifer was found to be very hard. The chemical quality of the ground water appears to deteriorate somewhat in the southwestern part of the county.

HYDROGEOLOGY

Geology

In most parts of the county, the bedrock is composed of grey and black shale and shaly limestones of the Hamilton Group and Kettle Point Formation of Devonian age.

In the extreme southwestern corner of the county and in a narrow strip west of Port Alma, however, the bedrock is made up of brown and buff limestone and some chert of the Devonian, Dundee Formation.

The Hamilton Group forms the bedrock surface south of Bothwell in the eastern fringe of the county, south of Chatham, and in parts of Tilbury, Romney and Dover Townships. It is composed of grey shale and shaly limestone. The remainder of the county, which is the greater part, is underlain by black shale of the Kettle Point Formation.

Most of the overburden is composed of glacial drift, mainly clays, clay tills and some surface sand deposits.

The flat area, east and southeast of Lake St. Clair, is part of the St. Clair clay plains. The Blenheim moraine in the southeastern part of the county, has a relief of 20 to 30 feet and is generally wide. It has a width of almost seven miles at one point. Beaches, gravel bars and terraces occur near the edges of the moraine. Large sand plains occur in the area around Chatham and extend to the northeastern part of the county. The Thames River bisects the sandy areas. The sand deposits are deltaic in origin and range in thickness from a few feet to over 30 feet at Bothwell.

The thickness of the overburden in the county varies between about 30 feet in the Gore of the Township of Camden to over 400 feet in the southeast part of the Township of Orford. In the western and central part of the county, the thickness is about 70 feet. The southeastern part of Romney Township, the southern parts of the townships of Raleigh, Harwich, Howard and Orford have the deepest overburden.

Occurrence of Water

The majority of the water wells in the County of Kent obtain water from saturated sands and gravels of varying thicknesses immediately overlying the bedrock or from the upper few feet of the bedrock. In the southeastern part of the county, where the overburden is very thick, there are places where two deep aquifers may be present in the overburden. In the sand plain areas in the central and northeastern part of the county and also where beach sediments occur, the surface deposits are generally sufficiently coarse-grained for development of adequate domestic supplies at shallow depths. In these areas, the surface aquifer is used frequently instead of the deeper aquifer.

The thickness and grain size of the overburden deposits determine the rate of yield to wells. The surface sand deposits support many dug, bored and driven wells.

Many wells are drilled a few feet into the bedrock, perhaps to avoid screening of the overlying formation. Wells seldom penetrate deep into the bedrock. Where they do, they often have poor quality; i.e., salty or sulphurous water. Water in the bedrock generally occurs at fractures and bedding planes. About 33 per cent of the wells drilled in the county are reported to be dry or have insufficient water.

CHEMICAL ANALYSES OF WATER SAMPLES

Table 1. OWRC Laboratory Analyses

Sample or Well Number	Date	pH	Constituents in parts per million (ppm): Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Sodium Adsorption Ratio	Alkalinity as ppm $CaCO_3$	Total Hardness as ppm $CaCO_3$	Total Dissolved Solids (ppm)	Specific Conductance (micromhos at 25°C)
023	15/4/66	7.3	0.60						54	39	0.1		267	340		
456	16/9/69	7.8	0.40	35	12	334	3.7	320	1	455	1.5	12.4	263	139	1000	1785
536	15/9/69	7.7	3.50	35	12	168	4.6	536	1	58	0.7	6.2	440	138	570	925
1043	16/9/69	8.0	0.70	9	5	160	1.6	404	1	49	1.3	10.6	331	42	470	768
1314	16/9/69	8.1	0.20	6	3	403	2.5	412	1	399	1.6	33.4	338	29	1020	1840
1606	18/9/69	7.8	2.30	56	18	715	5.2	282	1	1112	0.7	21.3	231	218	2060	3740
1790	17/9/69	7.8	0.80	29	13	448	3.6	274	1	638	1.2	17.4	225	126	1290	2740
1840	17/9/69	7.6	1.60	53	27	2115	11.4	634	1	3168	0.8	59.0	520	244	5530	9780
1917	2/4/65	8.1	0.29						0	148	1.3		273	57		
2063	18/9/69	7.7	0.35	67	22	28	4.3	206	82	47	0.3	0.8	169	260	400	613
2089	1/4/65	8.1	0.48						Trace	69	1.5		272	44		
2111	1/4/65	8.2	3.66						0	71	1.2		268	48		
2116	2/4/65	8.0	0.75						0	65	1.4		297	44		
2363	1/4/65	8.0	1.54						0	145	1.1		294	58		
2377	18/9/69	7.8	1.25	14	7	193	1.7	396	1	122	1.0	10.5	325	64	570	970
2392	1/4/65	8.0	0.18						0	131	0.9		324	92		
2480	1/4/65	7.8	1.37						0	1335	1.1		272	236		
2490	1/4/65	8.0	5.36						Trace	92	1.2		50	92		
2614	11/9/69	8.0	0.40	15	8	214	4.5	332	1	204	2.0	11.1	272	70	610	1130
2617	16/11/60	8.0	0.60							79			202	58		
2627	16/11/60	7.6	1.12							181			268	161		
2635	16/11/60	8.1	0.22							99			214	66		
2668	16/11/60	8.2	0.26							336			242	47		
2676	16/11/60	7.9	0.16							101			270	80		
2711	10/9/69	7.8	3.25	23	10-	216	3.7	305	Trace	228	1.2	9.5	250	99	630	1160
2741	10/9/69	8.3	1.45	7	3	208	4.8	251	1	203	1.6	18.5	206	31	460	1030
3057	10/9/69	7.6	2.00	63	18	14	2.0	306	1	6	0.5	0.4	251	232	250	466
3327	8/61	8.1	0.44							16	1.8		155	35		
3386	12/9/69	8.0	2.05	16	8	181	3.1	282	1	171	1.2	9.2	231	73	530	960
3434	4/4/67	8.4	0.80							33			160	52		
3479	5/4/67	8.0	0.72							102			193	78		
3502	10/9/69	7.8	0.75	20	9	118	2.9	284	2	75	1.4	5.5	233	87	330	669
3522	12/9/69	8.0	0.65	16	10	61	1.8	205	1	29	1.2	2.9	168	82	240	401
3588	15/9/69	7.9	0.70	30	14	144	2.7	126	1	238	1.1	5.4	103	132	570	945
3650	19/9/69	7.9	0.60	21	10	98	1.5	226	1	87	1.5	4.4	185	95	340	740
3723	9/9/69	8.1	0.40	18	10	279	3.9	194	1	384	1.5	13.1	159	89	840	1540
3765	10/9/69	7.9	9.50	27	12	188	3.4	402	Trace	139	1.1	7.6	330	117	570	1020
3979	9/9/69	8.1	0.60	17	7	213	3.2	277	1	215	1.5	11.0	227	73	610	1090
4386	8/9/69	8.2	1.50	56	43	1538	19.0	256	5	2578	1.6	37.6	210	319	4430	7800
4450	8/9/69	7.7	9.00	89	41	685	6.8	104	Trace	1312	0.9	15.1	85	396	2510	4110
4454	9/9/69	7.9	4.00	32	16	320	3.0	250	1	467	1.2	11.5	205	146	990	1830
4470	9/9/69	7.7	1.15	42	29	561	6.9	216	11	934	1.2	16.3	177	244	1810	3300
S-1	4/4/67	8.4	0.09							13			146	38		
S-2	4/4/67	8.3	1.25							35			173	64		
S-3	5/4/67	7.6	0.42							19			281	452		
S-4	16/11/60	7.9	1.88							1036			210	167		
S-5	16/11/60	8.1	1.88							81			230	90		
S-6	16/11/60	7.8	0.0							30			204	484		
S-7	16/11/60	8.0	0.20							211			256	50		

Table 2. Field Analyses

Sample or Well Number	Date: Sept. 1969	pH	Total Iron	Chloride	Alkalinity	Total Hardness
032	16	7.6	0.3	75	253	103
109	16	7.6	0.2	52	349	103
267	16	7.7	0.2	128	356	103
505	16	7.5	0.2	112	351	222
531	16	7.6	0.0	105	287	154
786	16	7.6	0.4	60	486	103
1008	16	7.9	0.7	128	349	120
1066	16	7.9	0.4	90	349	103
1130	16	7.9	1.6	180	300	103
1178	16	8.0	0.4	188	315	86
1367	17	7.7	0.9	322	383	120
1436	17	7.9	1.8	420	362	103
1561	17	7.7	0.7	720	369	137
1835	17	7.5	1.5	1290	383	171
1861	17	8.0	0.3	322	335	103
1912	17	8.0	1.8	232	458	137
1918	17	7.5	0.8	150	315	103
2079	18	7.9	0.3	150	417	86
2266	18	8.0	3.6	420	438	154
2335	18	7.4	0.6	172	438	462
2432	18	7.7	0.7	262	260	154
2447	18	7.6	0.9	4200	219	992
2505	18	7.7	0.9	615	198	154
2520	17	8.0	1.3	510	335	137
2544	18	7.9	1.0	532	150	154
2597	10	7.9	1.6	270	344	274
2604	10	7.9	1.6	210	246	154
2642	11	7.6	3.6	1200	274	222
2665	10	7.9	1.9	630	198	188
2702	10	7.3	1.3	540	267	205
2765	11	7.5	0.3	90	192	103
2774	11	7.9	0.4	68	212	120
2805	11	7.2	3.5	38	308	359
2865	11	7.9	1.2	38	253	154
3004	11	7.8	0.5	68	192	103
3029	11	7.5	2.5	22	239	222
3074	11	7.4	1.3	30	260	188
3238	11	7.8	1.1	52	205	103
3335	11	8.0	2.6	90	260	137
3457	11	8.1	0.6	75	232	86
3472	12	7.6	0.6	68	226	86
3527	12	7.0	1.5	98	239	120
3546	12	7.9	1.7	300	274	68
3566	12		0.5	3240	182	103
3593	12	7.6	0.7	22	185	68
3599	12	7.5	0.5	60	198	86
3613	12	8.0	0.2	38	171	68
3628	12	7.9	0.2	60	239	68
3660	15	7.9	0.2	45	164	103
3669	15	7.9	1.2	30	259	86
3680	15	7.7	0.9	68	239	86
3685	15	7.0	2.4	1200	96	393
3734	10	7.5	2.5	270	458	171
3736	10	8.0	2.1	150	287	86
3748	9	7.9	1.7	750	171	188
3841	10	7.7	1.7	1140	246	342
3862	9	7.8	0.4	180	331	68
3948	10	7.9	1.2	2940	321	256
3975	10	7.0	0.2	82	287	513
4382	8	7.6	0.2	300	359	324
4410	8	7.5	2.0	1740	157	782
4435	9	6.8	4.8	1860	171	479
4492	9	7.6	1.6	1050	144	325
4515	9	8.0	1.8	442	103	256
4533	15	7.0	1.0	75	328	376
4564	15	7.6	0.4	68	274	137
4570	15	7.6	3.7	345	205	187
4580	16	7.9	0.9	105	321	86
4609	16	7.7	1.6	120	404	120

ONTARIO WATER RESOURCES COMMISSION
DIVISION OF WATER RESOURCES

MAP 3117-1

GROUND WATER PROBABILITY MAP

COUNTY OF KENT

Scale 1:100,000

1 inch equals 1.58 miles

Miles

Kilometres